RDD&D Opportunities in the Office of Energy Efficiency and Renewable Energy

Sam Baldwin
Chief Technology Officer and Member, Board of Directors
Office of Energy Efficiency and Renewable Energy
U.S. Department of Energy

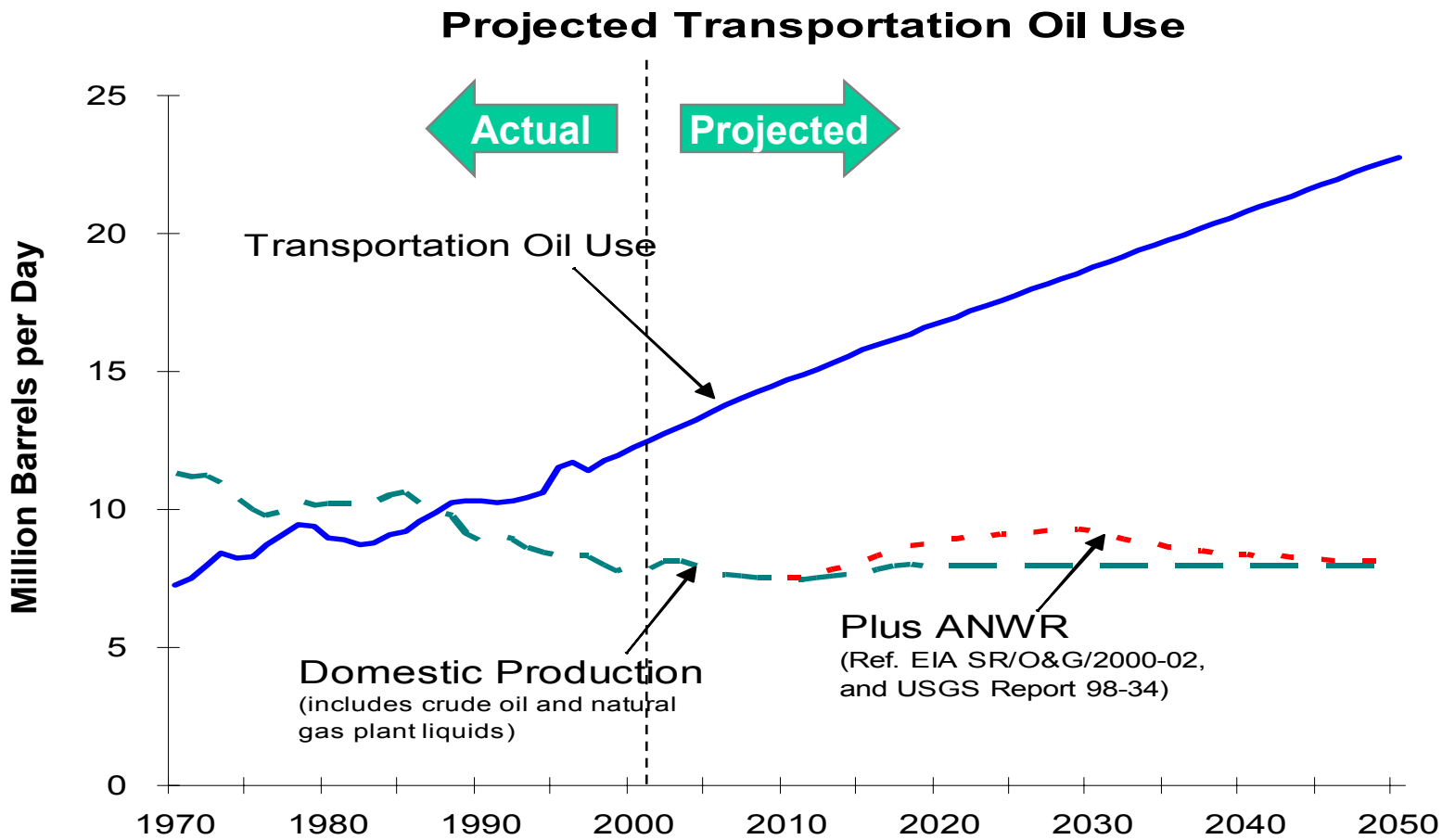
The Oil Problem

Nations that HAVE oil (% of Global Reserves)	
Saudi Arabia	26%
Iraq	11%
Kuwait	10%
Iran	9%
UAE	8%
Venezuela	6%
Russia	5%
Mexico	3%
Libya	3%
China	3%
Nigeria	2%
U.S.	**2%**

Nations that NEED oil (% of Global Consumption)	
U.S.	**26%**
Japan	7%
China	6%
Germany	4%
Russia	3%
S. Korea	3%
France	3%
Italy	3%
Mexico	3%
Brazil	3%
Canada	3%
India	3%

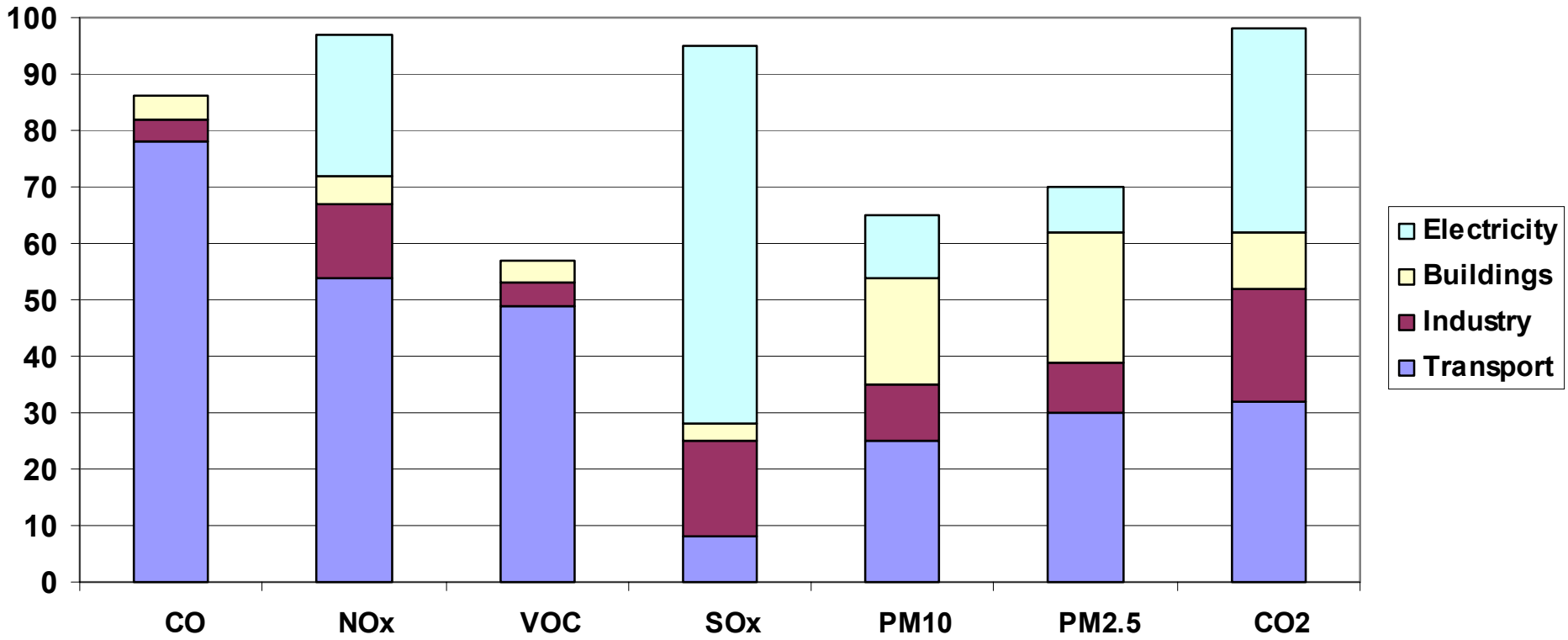
Source: EIA International Energy Annual 1999

The Oil "Gap" Is Growing



Beyond 2020, EIA data extrapolated

U.S. 1998 Energy-Linked Emissions as Percentage of Total Emissions



EERE Vision, Mission, and Goals

Vision: A prosperous future where energy is clean, abundant, reliable, and affordable.

Mission: Strengthen America's energy security, environmental quality, and economic vitality **through public-private partnerships** that:

- Promote energy efficiency and productivity;
- Bring clean, reliable, and affordable energy technologies to the marketplace;&
- Make a difference in the everyday lives of Americans by enhancing their energy choices and their quality of life.

Goals:

1. **End dependence on foreign oil**.
2. Reduce burden of energy prices on disadvantaged.
3. **Increase viability and deployment of renewable energy.**
4. **Increase reliability and efficiency of electricity generation.**
5. **Increase the efficiency of buildings and appliances.**
6. **Increase the efficiency/reduce the energy intensity of industry.**
7. **Create the new domestic bioindustry**.
8. Lead by example through Government's own actions.
9. Change the way that EERE does business.

EERE Programs and FY03 Funding

• Biomass	$111 M
• Building Technologies	$ 67 M
• DER	$ 61 M
• FEMP	$ 21 M
• FreedomCAR & Vehicle Technologies	$177 M
• Geothermal	$ 29 M
• Hydrogen, Fuel Cells & Infrastructure	$ 94 M
• Industrial Technologies	$ 99 M
• Solar	$ 84 M
• Weatherization & Intergovernmental	$329 M
• Wind & Hydropower	$ 47 M
TOTAL	$1,308 M
• SBIR	~$ 40 M

Biorefinery

Biomass Feedstock

– Trees
– Forest Residues
– Grasses
– Agricultural Crops
– Agricultural Residues
– Animal Wastes
– Municipal Solid Waste

Conversion Processes

- Acid Hydrolysis/Fermentation
- Enzymatic Fermentation
- Gas/liquid Fermentation
- Thermochemical Processes
- Gasification/Pyrolysis
- Combustion
- Co-firing

USES

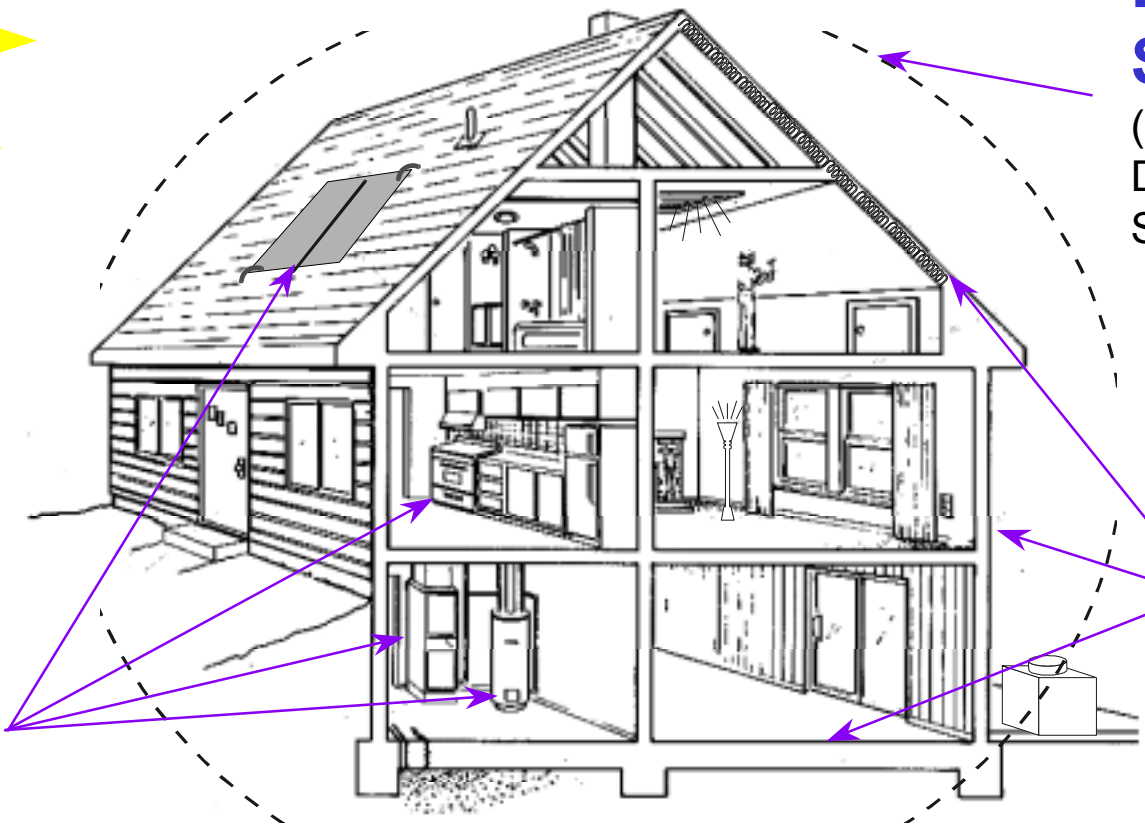
Fuels:
Ethanol
Renewable Diesel
Methanol
Hydrogen

Electricity

Heat

Products
– Plastics
– Foams
– Solvents
– Coatings
– Chemical Intermediates
– Phenolics
– Adhesives
– Fatty acids
– Acetic Acid
– Carbon black
– Paints
– Dyes, Pigments, and Ink
– Detergents
– Etc.

BUILDINGS



Buildings consist of a complex system of interacting components facing variable input conditions

Building Systems

("whole-systems")
Design tools
System Integration

Building Envelope

Windows

Building Equipment

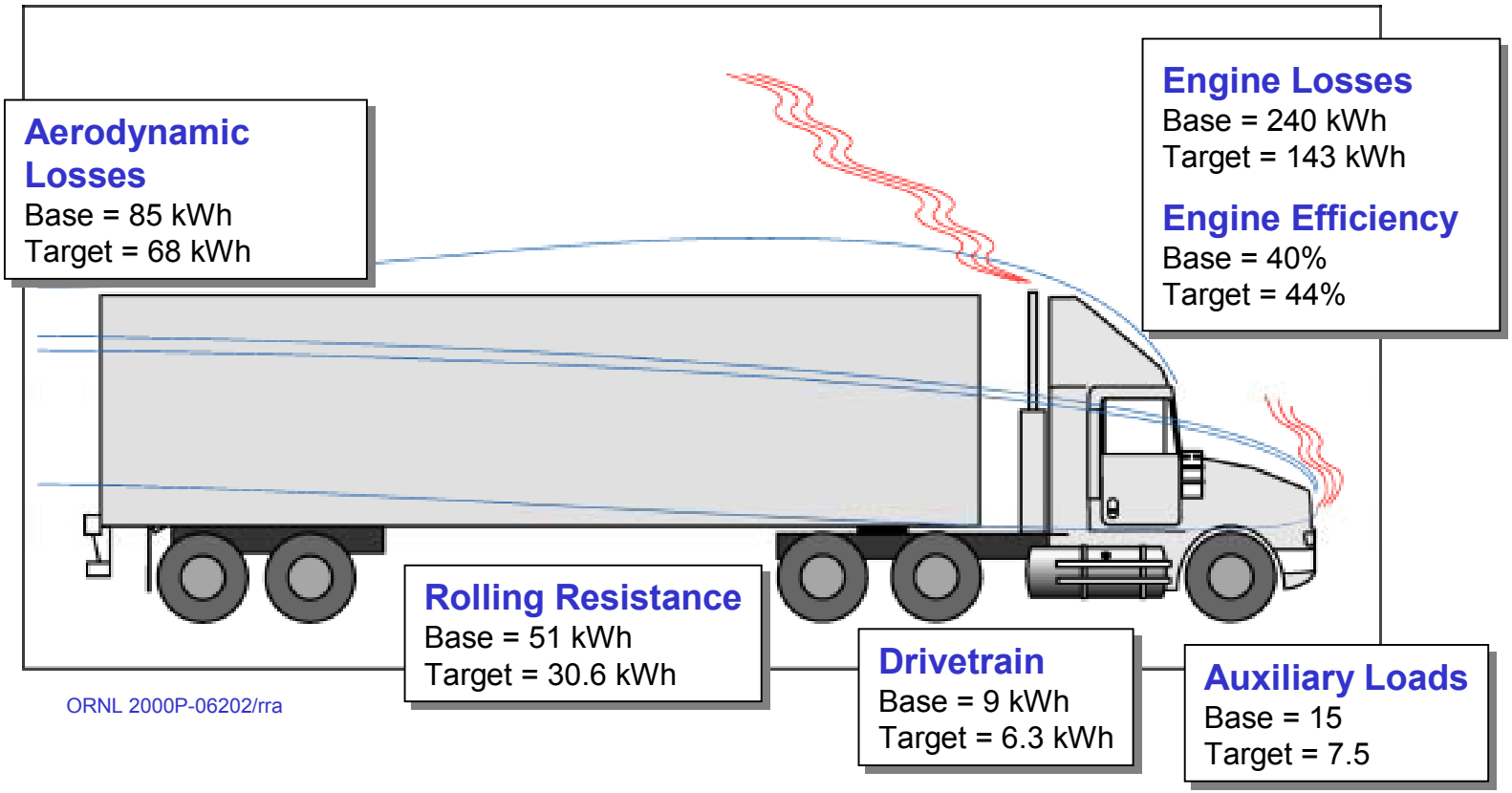
Space conditioning
Lights
Appliances
BIPV, PEM-FC

Materials Intensity

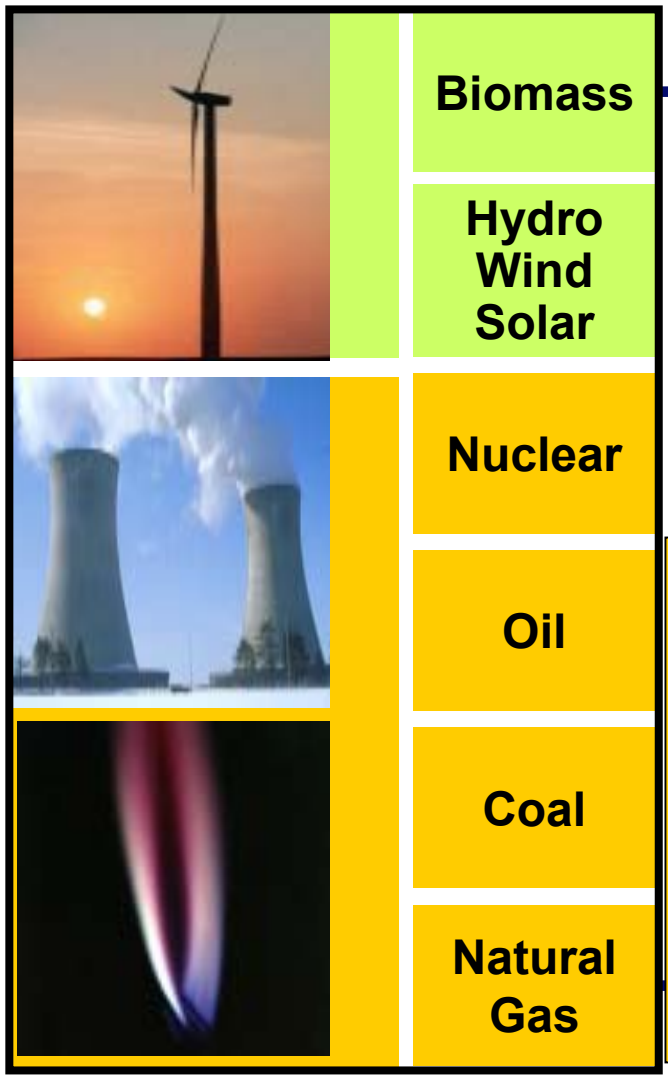
Class 8 Truck Energy Audit

Total Energy Used Per Hour
(65 mph, fully loaded, level road for one hour)

Base = 400 kWh (6.6 mpg) • Target = 255.5 kWh (10.3 mpg)



Hydrogen: It's abundant, clean, efficient, and can be derived from diverse domestic resources.



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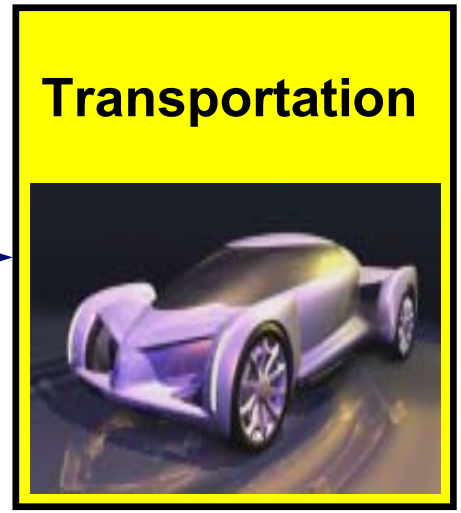
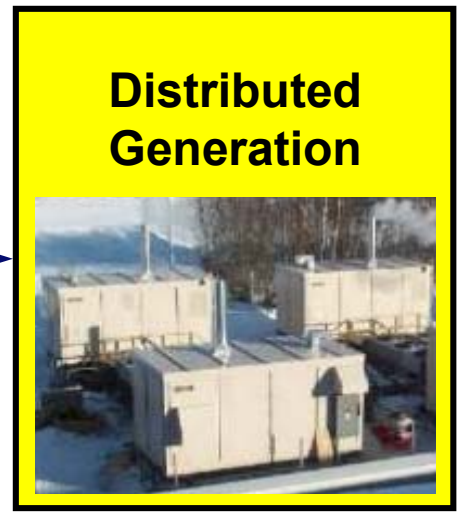
HIGH EFFICIENCY & RELIABILITY

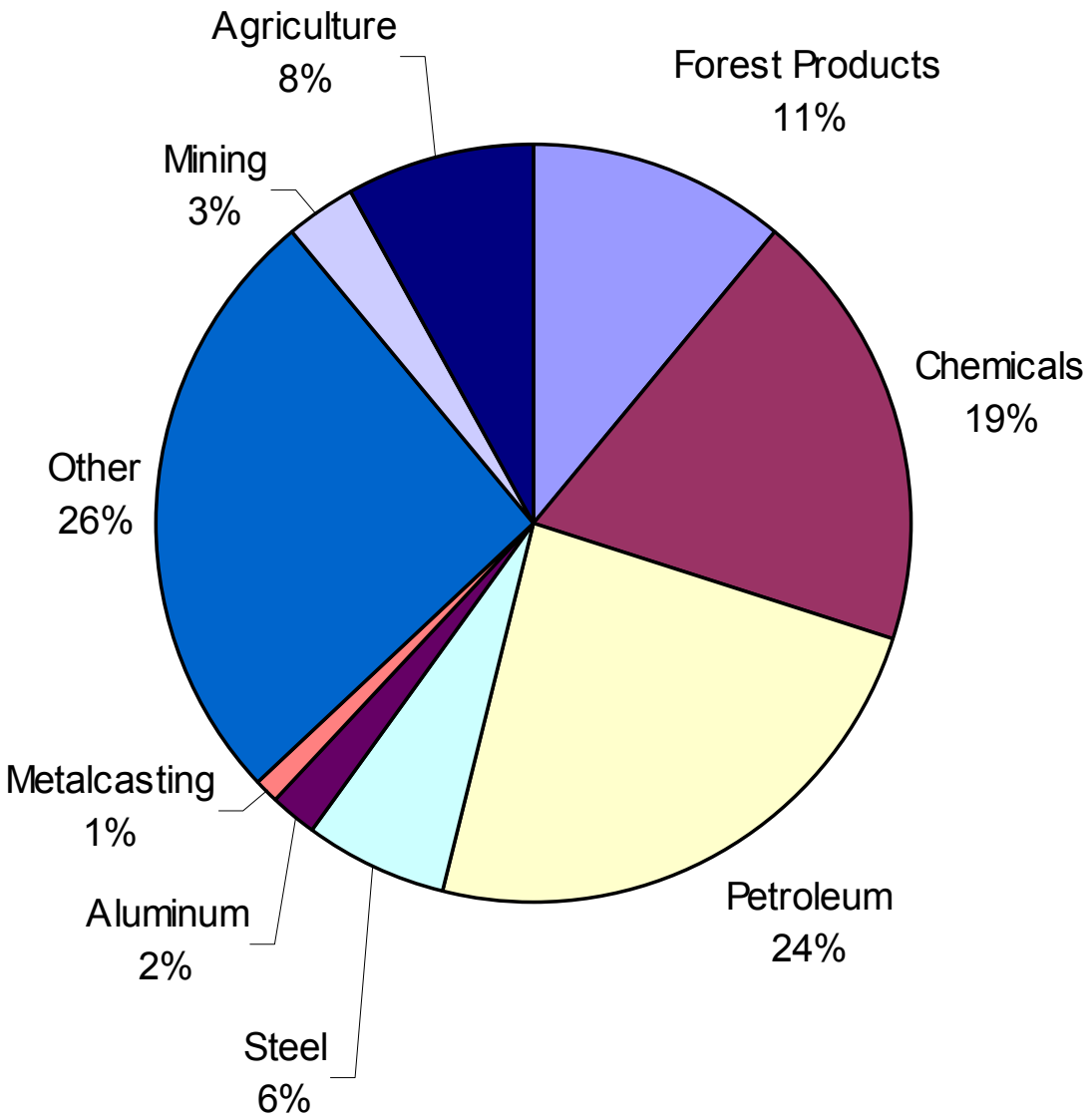
ZERO/NEAR ZERO EMISSIONS





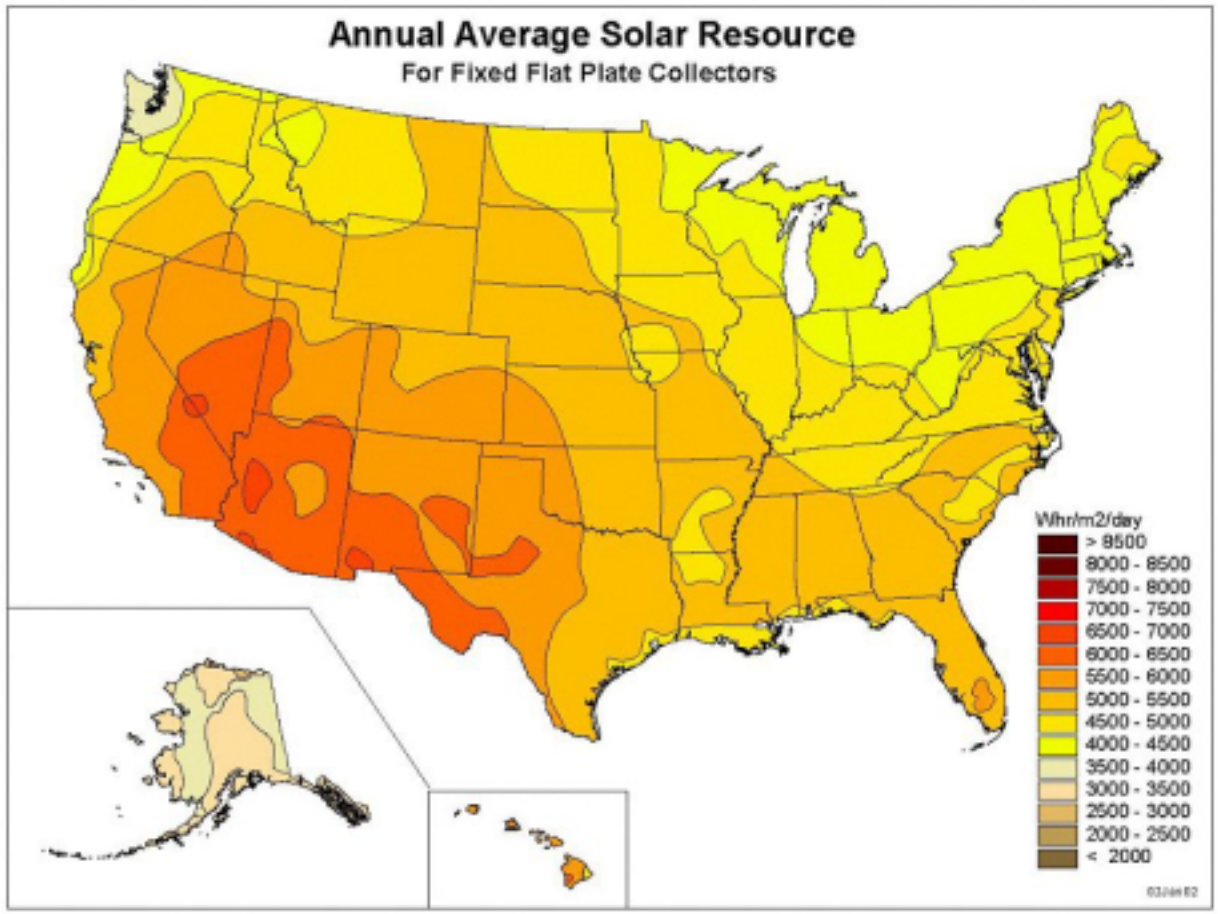
Industrial Energy Use

(35 Quads, 1999)

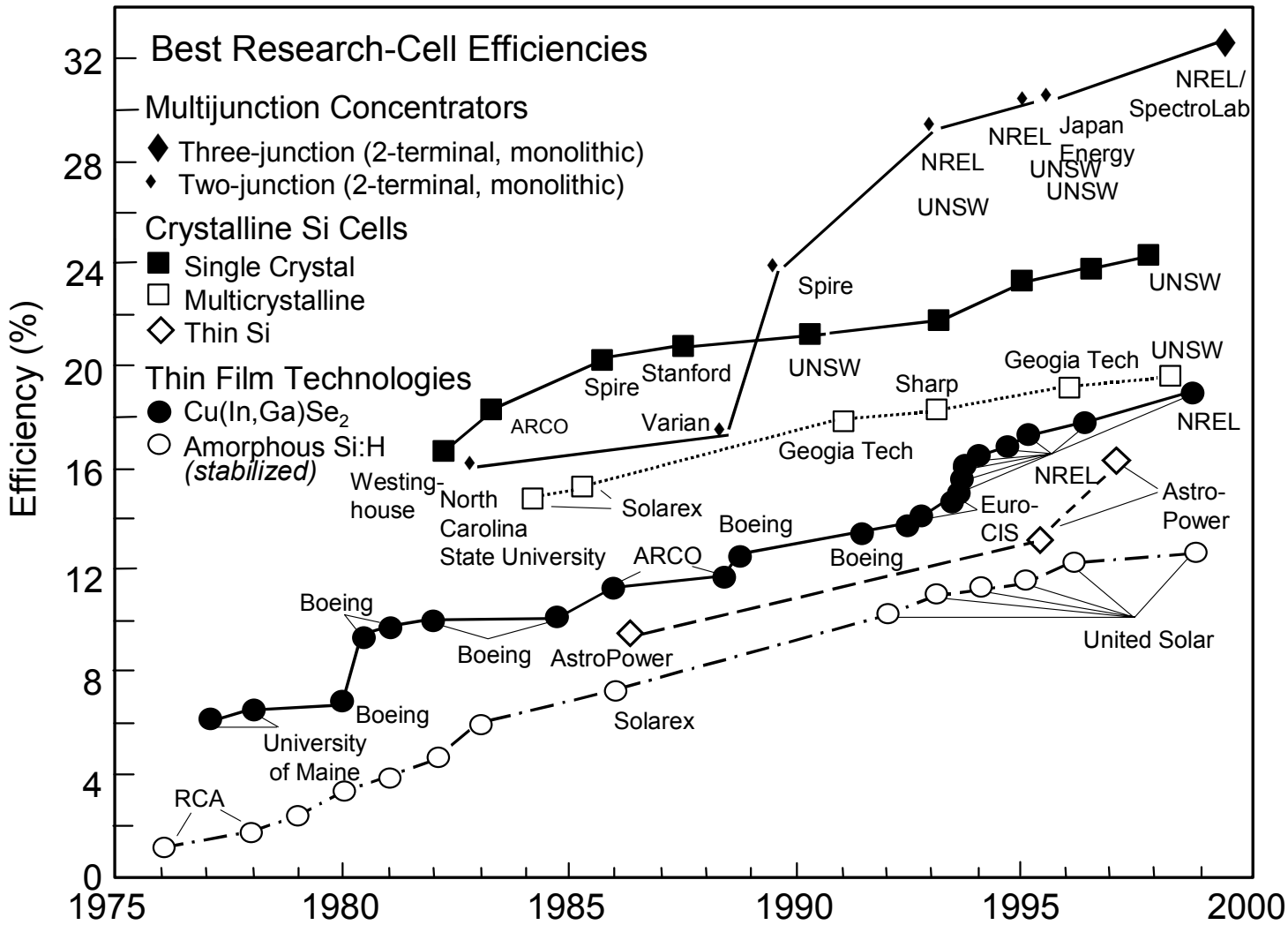


Prospects for Solar (PV)

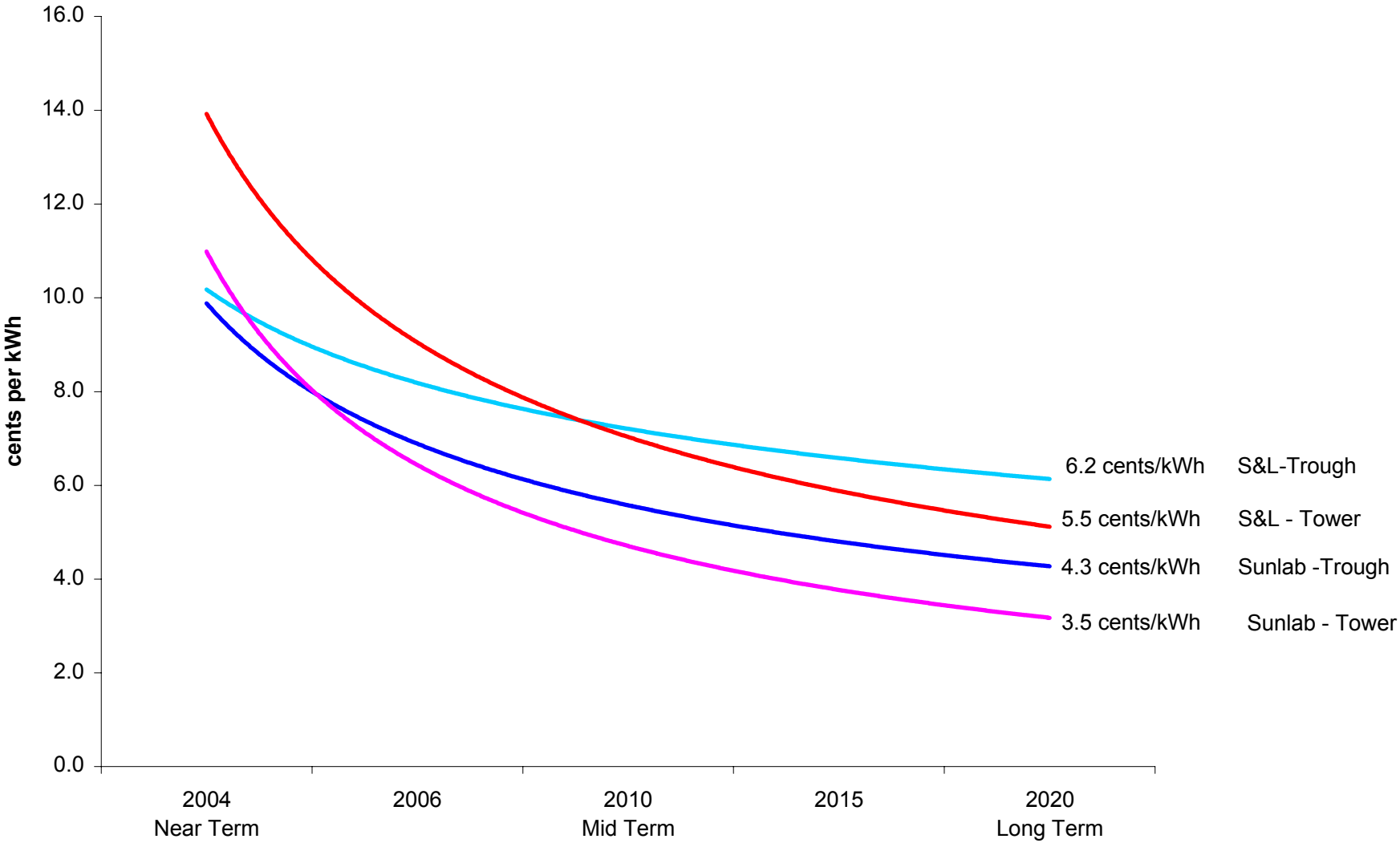
- Price of electricity from grid-connected PV systems are 20 to 30¢/kWh.
  - Down from $2.00/kWh in 1980
- 2020 R&D goal is 6¢/kWh.



BEST RESEARCH CELL EFFICIENCIES

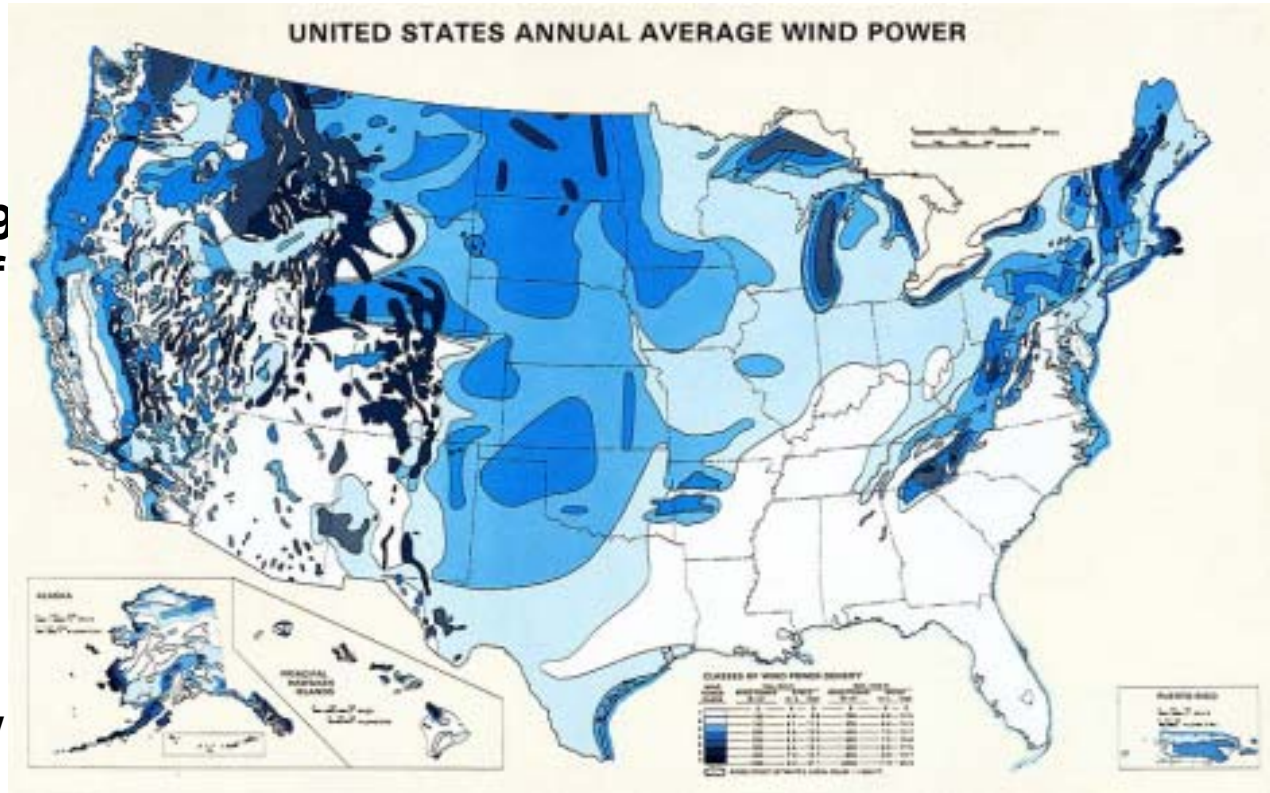


Comparison of Trough and Tower



U.S. Wind Resource

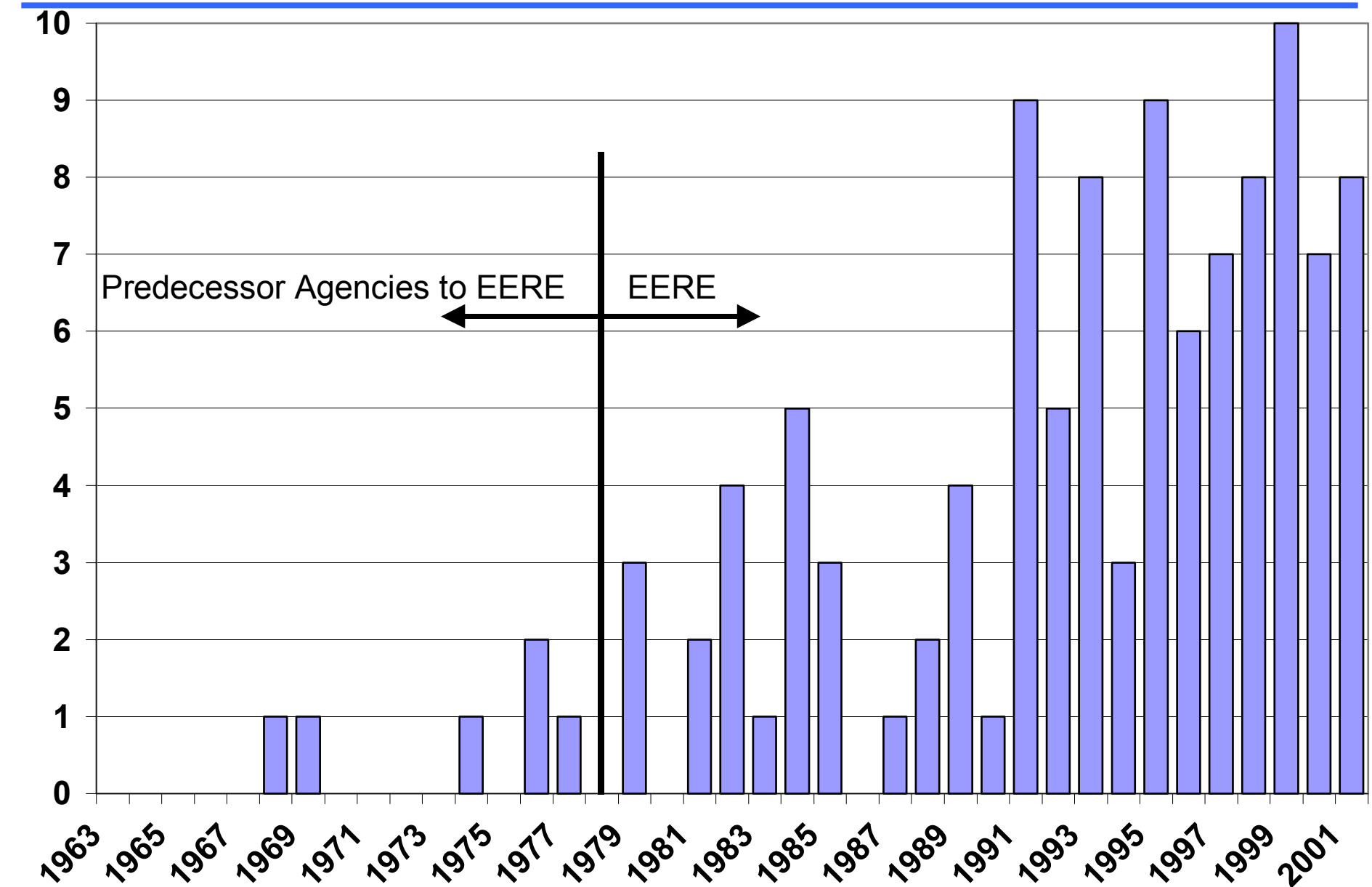
- R&D has reduced cost of wind power from 80 cents per kilowatt-hour in 1979 to a current range of 4-6 cents per kilowatt-hour (Class 6).
- 2010 target: 3 cents per kilowatt hour (in Class 4 and above regimes.
- New R&D focus: low speed wind tech.; x20 resource; x5 proximity



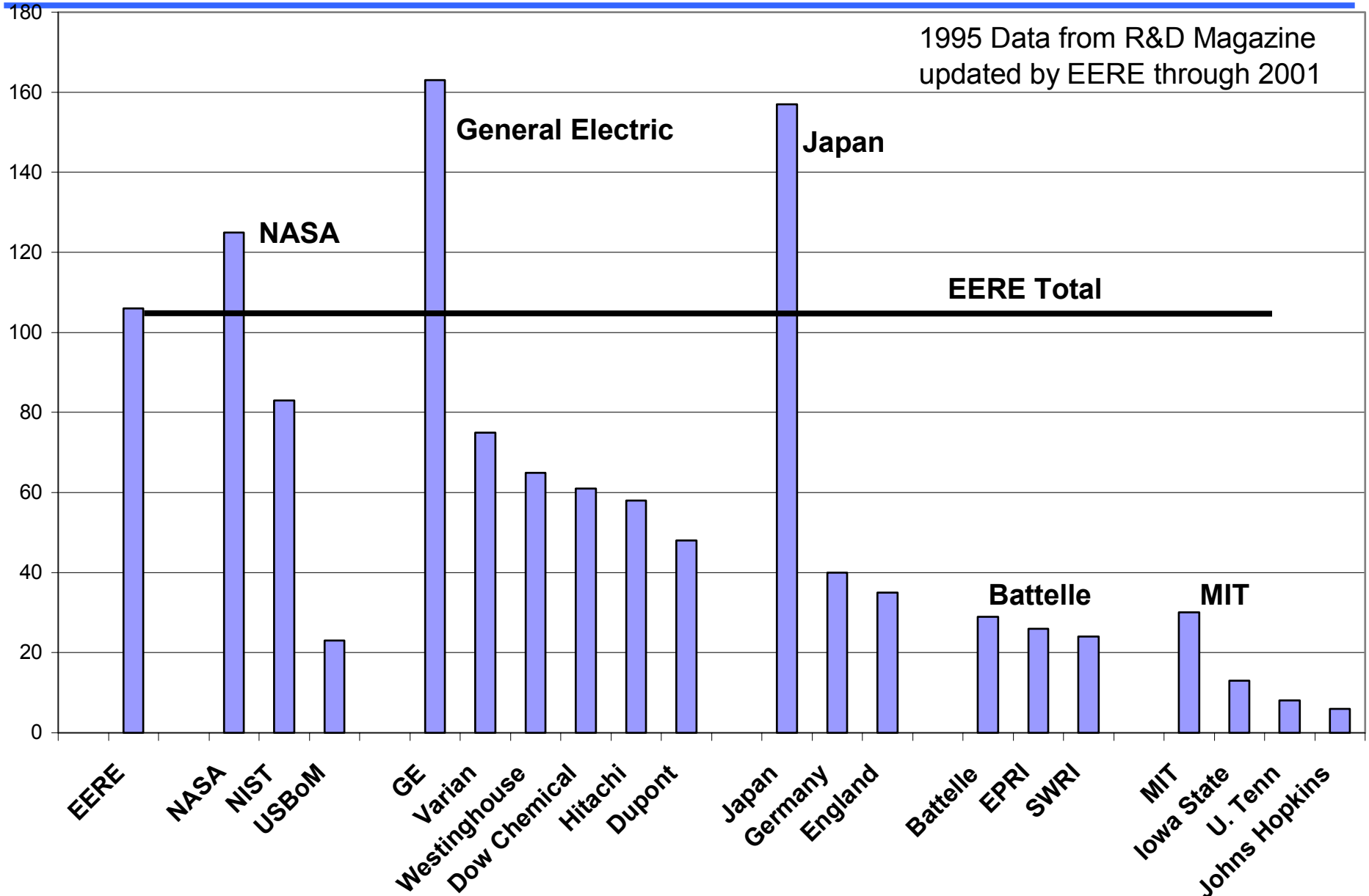
SBIR Topics, FY2004

- Energy Efficient Storage Technologies For Electric and Hybrid Vehicles
- Innovative Research For The Hydrogen Economy
- Nanotechnology Applications in Industrial Chemistry
- Reactive Separations
- Solid State Organic LEDs For General Illumination
- New Technologies For General Illumination
- Energy Efficient Membranes
- Materials For Industrial Energy Systems
- New Energy Sources
- Sensors and Controls
- Innovative Waste Heat Recovery

R&D100 Awards for EERE Sponsored R&D



R&D100 Awards by Organization

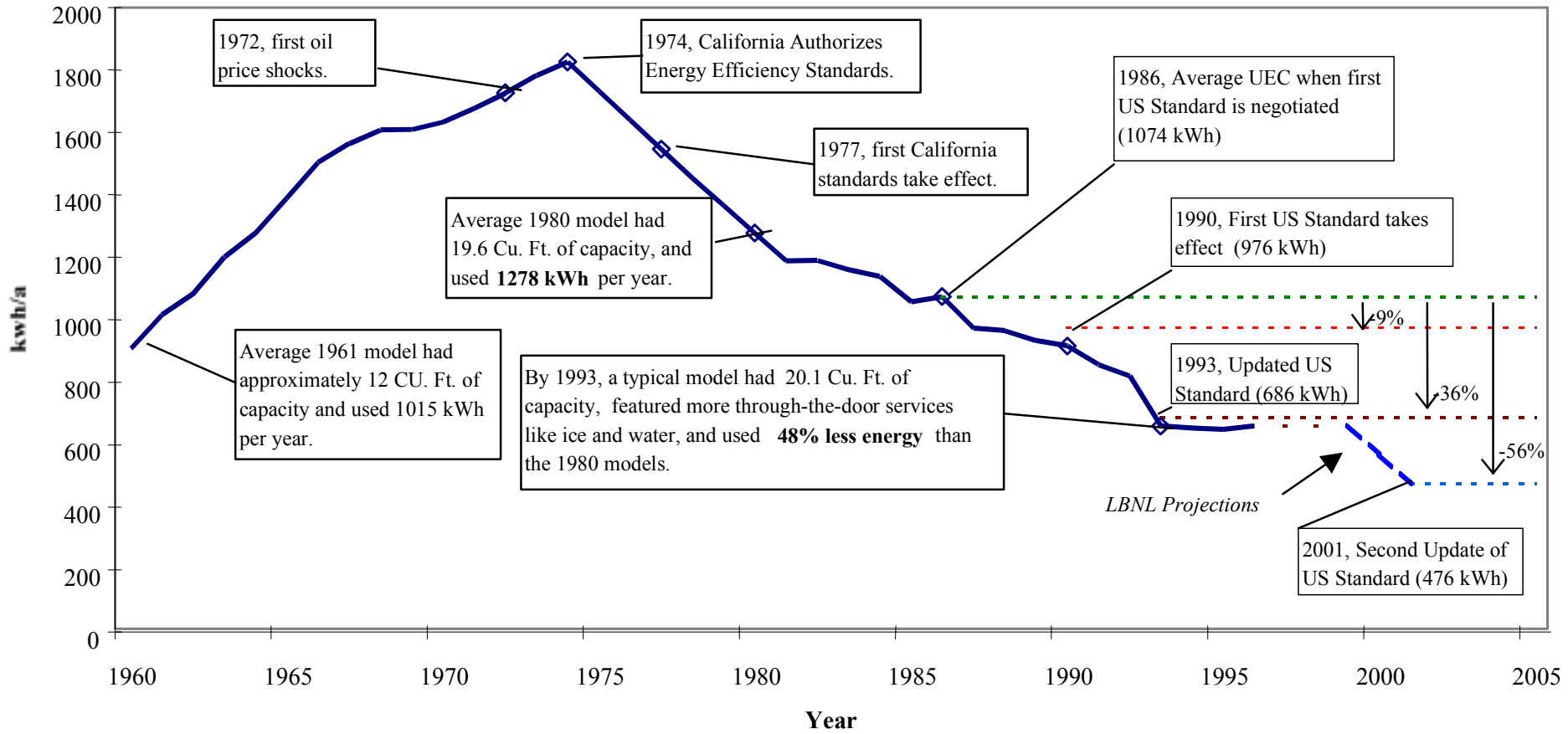


Benefits

- **NAS analysis**
  - $30 B net realized economic benefit on portfolio of $1.6B R&D;
  - NAS estimated additional environmental benefit of $3-$20 billion
- **Technologies to examine**
  - Buildings: Advanced refrigerators/freezers; Spectrally selective windows; Condensing Gas Furnaces; Flame Retention Head Oil Burner; DOE-2; Indoor Air Quality; Energy Star, Low-Income Weatherization; Codes and Standards: refrigerators/freezers, A/C, clothes washers, clothes dryers, dishwashers, water heaters, furnaces, electronic ballasts.
  - FEMP
  - Industry: Direct Steelmaking; Intermetallic Alloys, 140 technologies tracked
  - Transport: Catalytic converters for CIDI, heavy diesels, transportation materials—structural ceramics and lightweight materials; advanced batteries
  - Power: Biopower, Geothermal, Photovoltaics, Wind,

U.S. Refrigerator Energy Consumption

(Average energy consumption of new refrigerators sold in the U.S.)



Opportunities and Constraints

Reducing Risk:

- Can provide long-term RDD&D funding.
- Cost share RDD&D with partners.
- Support standards development in some cases.
- Provide extensive independent information about technologies.
- Participate in the policy process.

Constraints

- Appropriation of funds not assured.
- Cannot underwrite, warranty, etc. technologies.
- Work is done under public scrutiny.

Further Information: http://www.eere.energy.gov

Time Constants

- **Consensus building** **~ 2-20+**
- **Science** **~10+**
- **Technical R&D** **~10+**
- **Production model** **~ 4+**
- **Financial** **~ 2+**
- **Market penetration** **~10-20+**
- **Capital stock turnover** **~15-100+**
  - Cars 15
  - Appliances 10-20
  - Industrial equipment/facilities 10-30/40+
  - Power plants 40
  - Buildings 40-80
  - Urban form 100's

- **Lifetime of Greenhouse Gases** **~100's-1000's**